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URL-based access to Aspect Objects

5   TECHNICAL FIELD

The present invention is concerned with control systems
where real-world objects are represented as Aspect
Objects. The method and the system according to the
invention are particularly suitable for use in industrial

10   plants in industries such as a chemical, pharmaceutical,
food, metal, mines, building material, pulp and paper.
Other industries and utilities where the invention is
particularly useful are automotive, consumer products,
power generation, power distribution, waste water

15   handling, oil refineries, pipelines and offshore plat-
forms.

BACKGROUND ART

WO00102953 entitled "Method of integrating an application

20   in a computerized system" describes a method to represent
real-world objects in a computerized system in a syste-
matic way, in which different types of information about
the real-world object may be obtained, linked to the
real-world entity, processed, displayed and acted on. In

25   WO 01/02953, a real-world object is represented by a
certain kind of software object called a composite
object. Each application integrated in the computerized
system defines interfaces that are independent of the
implementation of the application itself. These inter-

30   faces may be used by other applications, implementing
other aspects or groups of aspects of a composite object
(in this description a composite object is referred to as
an Aspect Object), such that the applications can co-
operate to provide functionality for the representation

of a real-world entity that is the sum of all aspects. A
problem with the disclosed method is that it requires
that certain software modules be installed on a client
device in order to access the application integrated in
5   the system. Another problem with the method disclosed in
WO00102953 is that it does not disclose how to resolve
access to an aspect of Aspect Object via the Internet or
via an intranet based on Internet technology.

10   US 6,170,007 describes how a web server in a device
provides access to the user interface functions for the
device through a device web page. A network interface in
the device enables access to the web page by a web
browser such that a user of the web browser accesses the
15   user interface functions for the device through the web
page.

US 6,400,997 describes an apparatus and a method for
factory automation and tracking with focus on a factory
20   automation apparatus which includes a plurality of por-
table tablets and an automation server in a wireless
communication.

There are a number of enabling technologies that enable
25   remote access across a network. Examples of such techno-
logies are RPC (Remote Procedure Calls), DCOM (Distribu-
ted COM) and CORBA (Common Object Request Broker Archi-
tecture). Another example of a technology enabling remote
access to objects by use of Internet technologies is
30   called Web Services.

WO 0077653A1 describes a method and apparatus for provi-
ding network services for businesses. The description

discloses how HTTP (Hypertext Transfer Protocol) may be
used, including the HTTP methods GET and POST to provide
input data for a web service. The description also inclu-
des such functions as one called a Web Service Provider

5   and one called a Web Services Directory. The latter
function provides information about which web services
are available and where they may be found. A remaining
problem is how to get access from a web browser to dif-
ferent functions of a real-world object represented as an

10   Aspect Object, such as a CAD drawing or maintenance re-
cord of the device, where the functionality resides in a
number of unrelated applications.

SUMMARY OF THE INVENTION

15   An object of the invention is to provide access from a
web presentation means to an Aspect of an Aspect Object
representing a function of a real-world object and to
adapt a response message, not only to the performed
function, but also to contextual information about the

20   web presentation means. A web presentation means is any
type of presentation means used to access and present
information available via the Internet or an intranet. In
a preferred embodiment, the web presentation means is a
web browser. The contextual information describes charac-

25   teristics of the web presentation means.

The above object is achieved by a method comprising the
step of receiving a web request in a web server, which
web request is sent by a web presentation means and said

30   web request comprises a Uniform Resource Locator (URL),
which comprises means to identify the Aspect Object and
the Aspect of the Aspect Object. The method comprises the
additional step of identifying in a software application

the Aspect Object and the Aspect by use of information in
the URL. Further, the method comprises the step of
querying the identified Aspect Object from the software
application for an interface to an Aspect System Object

5   associated with the Aspect. The method also comprises the
step of querying the identified Aspect Object from the
software application for an interface to an Aspect System
Object associated with the Aspect. A further step is
receiving from the Aspect System Object to the software

10 application a reference to an interface of the Aspect
System Object, which implements the function of the
identified Aspect, and invoking functionality of the
Aspect by means of the reference. It also comprises the
further step of sending a response message to the world

15 wide web presentation means, which response message is
adapted to contextual information which describes charac-
teristics of the world wide web presentation means,
wherein the world wide web presentation means is updated
with the result of the performed function of the real-

20 world object.

According to a preferred embodiment, the contextual in-
formation is comprised in the web request sent from the
world wide web presentation means.

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According to another preferred embodiment, the response
message is adapted according to the contextual informa-
tion by an Aspect System Object.

30 In one embodiment, the response message is adapted as an
HTTP response. In another embodiment the response message
is adapted according to extensible markup language (XML).

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An advantage with the invention is that it enables access
from a web presentation means to an Aspect of an Aspect
Object without having to pre-install other software than
standard software on the client device.

5   Another advantage with the invention is that it enables
access to an Aspect of an Aspect Object from any type of
a device which hosts a web presentation means.

10   It should be appreciated that the Aspect associated with
capabilities of the above described method may be inheri-
ted to an Aspect Object other than the Aspect Object
previously referred to. Such inheritance is made in run-
time between Aspect Objects through a hierarchical struc-
15   ture, while the operation of the real-world objects is
maintained.

A further object of the invention is to provide a control
system comprising a web server, an Aspect Object, an
20   Aspect System Object and a software application characte-
rized in that the system executes the steps of the above
described method.

Yet another object of the invention is to provide a com-
25   puter program product which when run on a computer or a
processor causes said computer or processor to carry out
one or more steps of the above described method.

An Aspect Object is a certain type of software object.
30   Different functions or facets of a real-world object,
such as its physical location, the current stage in a
process, a control function, an operator interaction, a
simulation model, some documentation about the real-world

object are described as different Aspects of the Aspect
Object. Each Aspect Object is a container for one or more
Aspects. An Aspect Object is not an object in the tradi-
tional meaning of object-oriented systems, but rather a

5   container of references to such traditional objects,
which implement the different Aspects.

BRIEF DESCRIPTION OF THE DRAWINGS
The present invention will be described in more detail in

10 connection with the enclosed schematic drawings.

Figure 1 shows an overview of a method according to prior
art for a client application to access a software appli-
cation available for access via an Aspect System Object.

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Figure 2 shows a schematic overview of a method based on
the invention.

Figure 3 shows a schematic overview of a system based on

20 the invention where a user of a web presentation means
such as a thin client gets access to a function of a
real-world object accessible via an Aspect System Object
via a web server.

DETAILED DESCRIPTION OF THE INVENTION

In order to appreciate the invention it is advantageous
to study some specific prior art. WO00102953, hereby

5   incorporated by reference, describes a method for inte-
gration of many and various types of applications in a
computerized system, based on a concept where real-world
objects are represented as Aspect Objects. Figure 1 shows
a schematic overview of how, according to prior art, a

10 client application 1 queries an Aspect Object 3 for a
function associated with an Aspect, the system finds a
reference to an interface of an Aspect System Object 8 by
means of a Table look-up 4, the reference is returned to
the client 9. The Aspect System Object 12 may contain

15 several references to traditional objects and software
applications.

Figure 2 shows an overview of a method according to the
invention. The invention enables access to at least one

20 aspect of an Aspect Object 3 from a world wide web (www)
presentation means 26. A world wide web presentation
means 26 is any type of presentation means used to access
and present information available via the Internet or an
intranet. An example of a world wide web presentation

25 means is a web browser. Examples of devices capable of
executing such world wide web presentation means 26 are a
personal computer, a cell phone, a Personal Digital
Assistant (PDA) or a hand-held computing device. In a
preferred embodiment, no additional software is necessary

30 to be pre-installed in such a device hosting the world
wide web presentation means 26. It should be appreciated
that by using an embodiment of the invention, a user 31
(shown in figure 3), such as a process operator, may

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select and access an Aspect of an Aspect Object 3 from a
standard world wide web presentation means 26. This in
contrast to what was previously known in prior art.

5   Further figure 2 shows that a web server 21 and a soft-
ware application 27 provides access to an Aspect of an
Aspect Object 3 relating to a real-world object 13, such
as the real-world object shown in figure 3. The presenta-
tion of the Aspect Object 3 can be made in multiple ways.
10   As an example the world wide web presentation means 26
may present the Aspect Object 3 in structures or in pro-
cess graphics. The world wide web presentation means 26
may also present the Aspect Object 3 in text fields,
which is a particular advantage if the world wide web
15   presentation means 26 executes on a device with a small
display such as a cell phone. A method according to the
invention provides a response to a request for a function
of a real-world object 13 connected to a control system
30, which function is represented as an Aspect of an
20   Aspect Object. In a method according to the invention,
the world wide web presentation means 26 may choose to
invoke a certain Aspect of an Aspect Object 3. Figure 3
shows that the request for a function to a system based
on the invention may be initiated by a user 32, such as a
25   process operator or engineer. As an example, initiating
a request for a function is performed by a point-and-
click action by the user on a PDA or a personal computer.

Figure 2 shows that in a method according the invention
30   the world wide web presentation means 26 sends a web
request 25 comprising a Uniform Resource Locator (URL)
address with the purpose of getting access to such an
Aspect. An example of such a URL is

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http://xyz.com/production?object=pump&aspect=faceplate
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In the example above, the Aspect Object 3 is a pump and

5   the Aspect of the pump is a face plate. The URL comprises
    means to identify an Aspect Object 3 and also means to
    identify an Aspect of that Aspect Object 3. The means to
    identify an Aspect Object 3 may be a name, a path, an
    object id or other identification used in the URL in

10 order to identify the Aspect Object 3. The URL also
    comprises a name, id or other identification of the
    Aspect which in the example is the face plate. The URL
    above is an example and in an embodiment of the invention
    alternative syntax may be used. For instance, the URL

15 string may be comprised in a message defined according to
    extensible markup language (XML). Further figure 2 shows
    that, according to the method, the web server 21 passes
    the contents of the web request 25 to at least one soft-
    ware application 27. The software application 21 has also

20 received contextual information about the accessing world
    wide web presentation means 26. The contextual informa-
    tion may comprise information on type of browser, avail-
    able plug-ins, type of cell phone, screen resolution
    and/or national language. In a preferred embodiment of

25 the invention the contextual information of the world
    wide web presentation means 26 is included in the web
    request 25. The purpose of using the contextual infor-
    mation is to adapt the response message 20 to the web
    request 25 according to the information about the world

30 wide web presentation means 26. As an example, a response
    message, which comprises a text string, may be adapted to
    the size of the screen of a cell phone. Another example
    of how to utilize the contextual information is that,

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depending on the national language of the web presenta-
tion means, the response message may be adapted to the
national language.

5   The software application 27 identifies the Aspect Object
       3 and the Aspect from information specified in the URL.
       Further figure 2 shows that the software application 27
       queries the identified Aspect Object 3 through a known
       interface 2 for a reference to an interface of the Aspect
10   System Object 12 associated with the Aspect 5. The
       reference to the Aspect System Object 12 is found by
       means of a table look-up 4 where the table comprises a
       set of Aspects 6. Figure 2 also shows that the reference
       22a to an interface of the Aspect System Object 12, which
15   implements the identified Aspect, is received 22b by the
       software application 27.

       In a preferred embodiment, the contextual information is
       passed to the Aspect System Object 12. In the preferred
20   embodiment, it is the Aspect System Object 12 that deter-
       mines which algorithm to use to prepare a response mess-
       age depending on the contextual information about the
       world wide web presentation means 26.

25   Figure 2 shows in a schematic way that the reference 22a
       is received by the software application 27. The reference
       22a to the interface of the Aspect System Object 12 is
       preferably received by the software application 27
       through the Aspect Object 3, and that as a result of the
30   previously mentioned query sent through the known inter-
       face 2. In an alternative embodiment, the reference 22a
       may be received 22b directly by the software application
       27. The software application 27 invokes 23 functionality

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accessible by the Aspect System Object 12 by means of the
reference 22a. As mentioned above, in a preferred embodi-
ment the software application 27 passes the contextual
information or a reference to the contextual information
5   about the world wide web presentation means 26 to the
Aspect System Object 12. The Aspect System Object 12
performs the requested function defined as an Aspect of a
certain Aspect Object 3. Examples of such a function is
to close a valve, retrieve maintenance records of a motor
10   or present a list of available suppliers of a spare part.
Since the number of Aspect Objects in a control system is
typically several thousand, the above mentioned functions
are merely examples and should not in any way limit the
scope of the invention. Further, in the preferred embodi-
15   ment the Aspect System Object 12 prepares a response
message to the web request 25. The Aspect System Object
12 may, in order to handle the preparation of a response
message, download a COM or .NET component which matches
the information about the world wide web presentation
20   means 26. The response message is preferably an HTTP
response and is adapted to the world wide web presenta-
tion means 26. Figure 2 indicates that the HTTP response
may be sent 24 from the Aspect System Object 12 to the
software application 27 and further via 28a the web
25   server 21 to the world wide web presentation means 26.
One alternative compared to letting the Aspect System
Object 12 prepare an HTTP response is to delegate the web
request to a second URL and letting the Aspect System
Object 12 exclusively perform the requested function
30   defined in the URL as an Aspect of an Aspect Object.
Hence, in such an alternative it is functionality
accessed by the second URL that handles the adaptation of
the response message according to the contextual infor-

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mation. Yet another alternative, compared to letting the
Aspect System Object prepare an HTTP response, is to let
the Aspect System Object 12 prepare a response as exten-
sible markup language(XML) data. In such an alternative

5   embodiment, the Aspect System Object 12 generates a key
that describes the class of data. The key is used to
select a transform that converts the data into HyperText
Markup Language (HTML), which is passed back to the world
wide web presentation means 26 as a response message.

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In an alternative embodiment, the contextual information
is used by the software application 27 to determine which
reference 22a to the Aspect System Object 12 to query
for. In the alternative embodiment, it is the software

15 application that determines which algorithm to use in
order to adapt the response message according to the
contextual information. In the alternative embodiment,
the software application 27 receives 22b a plurality of
references 22a to the Aspect System Object 12 which each

20 implements the Aspect specified in the web request 25.

It should be appreciated that the Aspect associated with
capabilities of the above described method may be inheri-
ted to Aspect Object other than the Aspect Object pre-

25 viously referred to. The invention is particularly useful
in that the inheritance takes place during run-time of
the Aspect Objects, that is after the Aspect Objects have
been created and/or initiated. For instance, it may be so
that initially at a plant the method is applied to an

30 Aspect Object representing a certain type of Direct
Current (DC) motor with one type of characteristics. A
method according to the invention is easily applied to
another type of motor with other characteristics at a

later time by letting a corresponding Aspect Object
inherit the association of the Aspect System Object
capable of preparing a response message. Such inheritance
is made in run-time between Aspect Objects through a
5 hierarchical structure, while the operation of the real-
world objects is maintained.

Figure 3 shows an overview of a control system 30 based
on the invention. The control system 30 comprises a web
10 server 21, a software application 27, an Aspect Object 3
and an Aspect System Object 12 and is able to execute the
above described method.

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